

ARC-15058-1

2

Patent

1 (currently amended). A method of inductive learning comprising providing a computer that is programmed:

~~receiving to receive~~ training data, including at least one of archived data, simulated nominal data and off-nominal data;

~~providing to provide~~ vectors having a set of parameters ~~based on said~~ determined from the training data; and

~~generating to generate~~ a cluster database comprising clusters, ~~said clusters being that are~~ associated with respective ranges of values for at least a subset of ~~said the~~ set of parameters.

2-7 (canceled).

8 (currently amended). The method of claim 1 wherein said process of generating comprises:

determining a deviation distance between ~~one of said~~ a selected test vector[[s]] and one of said clusters, and

producing a new cluster including the test vector, if said when the distance exceeds a threshold value.

9 (currently amended). The method of claim 1 wherein said process of generating comprises:

determining a deviation distance between ~~one of said~~ a selected test vector[[s]] and at least one of said clusters, and

expanding ~~said one of said~~ the at least one cluster[[s]] to include ~~said the~~ test vector when ~~said the~~ distance is less than or equal to a threshold value.

ARC-15058-1

3

Patent

10 (currently amended). The method of claim 1, wherein said computer isfurther ~~comprising~~ programmed:

to indexing said clusters of said cluster database based on a distance of each of said clusters from a predetermined indexing reference point, and

to organize ~~organizing~~ said clusters into a data structure based on ~~said the~~ indexing.

11 (currently amended). A method of monitoring a system comprising providing a computer that is programmed:

to provide ~~providing~~ a cluster database comprising clusters ~~—said clusters—~~ being that are associated with respective ranges of values for at least a subset of a set of cluster parameters;

to receive at least ~~receiving one or more~~ monitored-system vector[[s]] having monitored-system parameters; and

to determine ~~determining~~ whether ~~said the at least one~~ monitored-system vector is contained in one of ~~said the~~ clusters based on at least a subset of ~~said the~~ monitored-system parameters and ~~said at least a the~~ subset of ~~said the~~ cluster parameters.

12 (currently amended). The method of claim 11, wherein said computer is further ~~comprising~~ programmed:

if when at least one of said monitored-system vectors is not contained in one of said clusters, to determine ~~determining~~ a distance of ~~said the at least one~~ monitored-system vector from a nearest of said clusters, ~~wherein said distance is associated~~ and to associate the determined distance with a severity of a deviation of said at least one monitored system vector from at least one of said clusters.

ARC-15058-1

4

Patent

13 (currently amended). The method of claim 12 wherein said computer is further programmed ~~determined distance provides:~~

to provide ~~providing~~ a comparison result, associated with said determined distance, for ~~each~~ said at least one monitored-system vector, ~~further comprising:~~ and .

~~supplying said at least one monitored-system vectors and said comparison result associated therewith to another learning application.~~

14 (currently amended). The method of claim 11, wherein said computer is further comprising ~~programmed:~~

to examine ~~examining~~ said monitored-system vectors to determine if ~~any~~ at least one of said parameters is erroneous; and

~~if any~~ when at least one of said monitored system parameters ~~of one of said monitored-system parameters~~ is erroneous, to adjusting ~~said the~~ erroneous parameter such that ~~said the erroneous~~ parameter will match any range specified for ~~said the~~ parameter in any cluster of said cluster database.

15 (currently amended). The method of claim 11, wherein said computer is further comprising ~~programmed:~~

to provide ~~providing~~ an additional cluster database, ~~the~~ of clusters, of ~~said additional cluster database being~~ associated with respective ranges of values for at least a subset of said set of parameters, ~~said the~~ additional cluster database being annotated with diagnostic information; and

~~if~~ when at least one of said monitored-system vectors is not included in ~~one any~~ of said clusters, to compare ~~comparing~~ said at least one of said

ARC-15058-1 5 Patent
monitored-system vectors with ~~said at~~ at least one of the clusters of said the
additional cluster database.

16-30 (canceled).

31 (currently amended). An apparatus for inductive learning comprising a
computer that is programmed:

~~a computer; and~~
~~one or more computer programs, executed by said computer, for~~
receiving to receive training data, including at least one of archived data,
simulated nominal data and off-nominal data;
~~providing to provide at least one vector[[s]] having a set of parameters~~
based on said training data; and
~~generating to generate a cluster database comprising clusters, said~~
~~clusters being associated with respective~~ selected ranges of values for at least a
subset of ~~said the~~ set of parameters.

32-37 (canceled).

38 (currently amended). The apparatus of claim 31, wherein said process of
generating comprises:

determining a deviation distance between ~~one of said a test~~ vector[[s]]
and one of said clusters, and
producing a new cluster if ~~said the deviation~~ distance exceeds a threshold
value.

ARC-15058-1

6

Patent

39 (currently amended). The apparatus of claim 31 wherein said process of generating comprises:

determining a deviation distance between ~~one of said~~ a test vector[[s]] and at least one of said clusters, and

expanding ~~said the~~ at least one of said clusters to include ~~said the~~ test vector when ~~said the~~ deviation distance is less than or equal to a threshold value.

40 (currently amended). The apparatus of claim 31, wherein said ~~one or more~~ computer programs, executed by said computer, further comprises, for computer is further programmed:

indexing to index said clusters of said cluster database based on a distance of each of said clusters from a predetermined indexing reference point.

41 (currently amended). An apparatus for monitoring a system, comprising

a computer, having a memory storing a cluster database comprising clusters, ~~said clusters being~~ associated with respective ranges of values for at least a subset of a set of cluster parameters, where the computer is programmed ~~and~~ :

~~one or more computer programs, executed by said computer, for~~ receiving to receive one or more monitored-system vectors having monitored-system parameters; and

~~determining to determine~~ whether ~~said the~~ monitored-system vector is contained in one of ~~said the~~ clusters based on at least a subset of ~~said the~~ monitored-system parameters and ~~said the~~ at least a subset of ~~said~~ cluster parameters.

ARC-15058-1

7

Patent

42 (currently amended). The apparatus of claim 41, ~~determining also for, if~~
wherein said computer is further programmed so that, when at least one of said
monitored-system vectors is not contained in one any of said clusters, said
~~determining computer~~ determines a distance of said the at least one monitored-
system vector from the a nearest of said clusters, wherein said the distance is
associated with a severity of a deviation of said at least one monitored system
vector from at least one of said clusters.

43 (currently amended). The apparatus of claim 42 wherein said computer is
further programmed so that said determined distance provides a comparison
result for each monitored-system vector, ~~said one or more computer programs~~
~~further comprising with~~.

~~supplying the monitored system vectors and their associated comparison~~
~~result to another learning application.~~

44 (currently amended). The apparatus of claim 41, ~~said one or more computer~~
~~programs also~~ wherein said computer is further programmed for examining said
monitored-system vectors, and, ~~if any~~ when at least one parameter of one of said
monitored-system vectors is erroneous, ~~said examination adjusts said the at least~~
one erroneous parameter is adjusted such that ~~said the at least one~~ parameter
will match any range specified for ~~said the~~ parameter in any cluster of said
cluster database.

45 (currently amended). The apparatus of claim 41, wherein said computer is
further programmed:

to memory also store[[s]] an additional cluster database of clusters that
~~are the clusters of said additional cluster database being~~ associated with

ARC-15058-1 8 Patent
respective ranges of values for at least a subset of said ~~set of~~ parameters, ~~said~~
the additional cluster database being annotated with diagnostic information; and
~~wherein, if~~ when one of said monitored-system vectors is not included in
~~one any~~ of said clusters, ~~said determining~~ to compare[[s]] said at least one of
said monitored-system vectors with ~~said the~~ clusters of ~~said the~~ additional
cluster database.

46 (new). The method of claim 8, wherein said computer is further programmed to determine said deviation distance by dividing said distance between said test vector and said one or said clusters by a value representing a range of values of at least one variable in said one of said clusters.

47 (new). The method of claim 9, wherein said computer is further programmed to determine said deviation distance by dividing said distance between said test vector and said one or said clusters by a value representing a range of values of at least one variable in said at least one of said clusters.

48 (new). The apparatus of claim 38, wherein said computer is further programmed to determine said deviation distance by dividing said distance between said test vector and said one or said clusters by a value representing a range of values of at least one variable in said one of said clusters.

49 (new). The apparatus of claim 39, wherein said computer is further programmed to determine said deviation distance by dividing said distance between said test vector and said one or said clusters by a value representing a range of values of at least one variable in the at least one of said clusters.